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<110> E. I. du Pont de Nemours and Company

<120> Plant Diacylglycerol Acyltransferases

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<150> 60/110,602

<151> 1998-12-02

<150> 60/127,111

<151> 1999-03-31

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<212> DNA

<213> Arabidopsis thaliana

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Gly Arg Gly Asn Ala Asp Ala Thr Phe Thr Tyr Arg Pro Ser Val Pro
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Leu Ile Arg Thr Asp Phe Trp Phe Ser Ser Arg Ser Leu Arg Asp Trp
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 340 345 350
 Glu Arg Val Leu Lys Leu Ser Val Pro Asn Leu Tyr Val Trp Leu Cys
 355 360 365
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 Glu Arg Phe Gly Ser Thr Val Gly Asn Met Ile Phe Trp Phe Ile Phe
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| gctactacct | gttttcacat | cctttttaca | acatttgaaa | ttgtatatcc | agtgctcgtg | 180 |
| attcttaagt | gtgattctgc | agttttatca | ggctttgtgt | tgatgtttat | tgccctgcatt | 240 |
| gtttggctga | agcttgatc | ttttgcacat | acaaaccatg | atataaggaa | aactgatcac | 300 |
| aagcggcaag | aagggtgata | atgaactgac | cgcggtggc | atagataatt | tacaanctcc | 360 |
| aactcttggg | agtctaaccat | acttcaagat | ggctccgaca | ctctgttatc | aagccaaagt | 420 |
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| gatatttact | ggctctcaag | gattcattat | tgagcaatac | ataaatccta | ttgttggtgaa | 540 |
| ctctcaacat | ccattgatgg | gaggattact | gaatgctgta | gagactgttt | tgaagctctc | 600 |
| attaccaaat | gtctacctgt | ggctttgcat | gttttattgc | cttttccatc | tgtgggttaaa | 660 |
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| aaagacaatt | gatgagtact | ggagaaaatg | gaacatgcct | gtgcataaat | ggattgttcg | 780 |
| tcatatatat | ttcccttgca | tgcgaaatgg | tatatcaaag | gaagttgctg | tttttatatc | 840 |
| gttcttttgt | tctgctgtac | ttcatgagtt | atgtgttgct | gttccctgcc | acataactcaa | 900 |
| gttctgggct | ttcttaggaa | tcattgcttca | gattccctc | atcatattga | catcatacct | 960 |
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 Phe Asn Asn Leu Val Ser Asp Pro Ala Thr Thr Cys Phe His Ile Leu
 35 40 45
 Phe Thr Thr Phe Glu Ile Val Tyr Pro Val Leu Val Ile Leu Lys Cys
 50 55 60
 Asp Ser Ala Val Leu Ser Gly Phe Val Leu Met Phe Ile Ala Cys Ile
 65 70 75 80
 Val Trp Leu Lys Leu Val Ser Phe Ala His Thr Asn His Asp Ile Gly
 85 90 95
 Lys Leu Ile Thr Ser Gly Lys Lys Val Asp Asn Glu Leu Thr Ala Ala
 100 105 110
 Gly Ile Asp Asn Leu Gln Xaa Pro Thr Leu Gly Ser Leu Thr Tyr Phe
 115 120 125
 Lys Met Ala Pro Thr Leu Cys Tyr Gln Ala Lys Val Ile Leu Arg Thr
 130 135 140
 Pro Tyr Val Arg Lys Gly Trp Leu Val Arg Gln Val Ile Leu Tyr Leu
 145 150 155 160
 Ile Phe Thr Gly Leu Gln Gly Phe Ile Ile Glu Gln Tyr Ile Asn Pro
 165 170 175
 Ile Val Val Asn Ser Gln His Pro Leu Met Gly Gly Leu Leu Asn Ala
 180 185 190
 Val Glu Thr Val Leu Lys Leu Ser Leu Pro Asn Val Tyr Leu Trp Leu
 195 200 205
 Cys Met Phe Tyr Cys Leu Phe His Leu Trp Leu Asn Ile Leu Ala Glu
 210 215 220
 Ile Leu Arg Phe Gly Asp Arg Glu Phe Tyr Lys Asp Trp Trp Asn Ala
 225 230 235 240

Lys Thr Ile Asp Glu Tyr Trp Arg Lys Trp Asn Met Pro Val His Lys
 245 250 255
 Trp Ile Val Arg His Ile Tyr Phe Pro Cys Met Arg Asn Gly Ile Ser
 260 265 270
 Lys Glu Val Ala Val Phe Ile Ser Phe Phe Val Ser Ala Val Leu His
 275 280 285
 Glu Tyr Val Leu Leu Phe Leu His Ile Leu Lys Phe Trp Ala Phe Leu
 290 295 300
 Gly Ile Met Leu Gln Ile Pro Leu Ile Ile Leu Thr Ser Tyr Leu Lys
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 Asn Lys Phe Ser Asp Thr Met Val Gly Asn Met Ile Phe Trp Phe Phe
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Ile Val Val Asn Ser Gln His Pro Leu Met Gly Gly Leu Leu Asn Ala
 35 40 45
 Val Glu Thr Val Leu Lys Leu Ser Leu Pro Asn Val Tyr Leu Trp Leu
 50 55 60
 Cys Met Phe Tyr Cys Leu Phe His Leu Trp Leu Asn Ile Leu Ala Glu
 65 70 75 80
 Ile Leu Arg Phe Gly Asp Arg Glu Phe Tyr Lys Asp Trp Trp Asn Ala
 85 90 95
 Lys Thr Ile Asp Glu Tyr Trp Arg Lys Trp Asn Met Pro Val His Lys
 100 105 110
 Trp Ile Val Arg His Ile Tyr Phe Pro Cys Met Arg Asn Gly Ile Ser
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35 40 45
Ile Leu Phe Thr Thr Phe Glu Ile Val Tyr Pro Val Leu Val Ile Leu
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Lys Cys Asp Ser Ala Val Leu Ser Gly Phe Val Leu Met Phe Ile Ala
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Cys Ile Val Trp Leu Lys Leu Val Ser Phe Ala His Thr Asn His Asp
85 90 95
Ile Arg Lys Leu Ile Thr Ser Gly Lys Lys Val Asp Asn Glu Leu Thr
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115 120 125
Tyr Phe Met Met Ala Pro Thr Leu Cys Tyr Gln Pro Ser Tyr Pro Arg
130 135 140
Thr Pro Tyr Val Arg Lys Gly Trp Leu Val Arg Gln Val Ile Leu Tyr
145 150 155 160
Leu Ile Phe Thr Gly Leu Gln Gly Phe Ile Ile Glu Gln Tyr Ile Asn
165 170 175
Pro Ile Val Val Asn Ser Gln His Pro Leu Met Gly Gly Leu Leu Asn
180 185 190
Ala Val Glu Thr Val Leu Lys Leu Ser Leu Pro Asn Val Tyr Leu Trp
195 200 205
Leu Cys Met Phe Tyr Cys Leu Phe His Leu Trp Leu Asn Ile Leu Ala
210 215 220
Glu Ile Leu Arg Phe Gly Asp Arg Glu Phe Tyr Lys Asp Trp Trp Asn
225 230 235 240
Ala Lys Thr Ile Asp Glu Tyr Trp Arg Lys Trp Asn Met Pro Val His
245 250 255

Lys Trp Ile Val Arg His Ile Tyr Phe Pro Cys Met Arg Asn Gly Ile
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 Ser Lys Glu Val Ala Val Phe Ile Ser Phe Phe Val Ser Ala Val Leu
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 35 40 45
 Ser Leu Val Tyr Phe Met Leu Ala Pro Thr Leu Cys Tyr Gln Pro Thr
 50 55 60
 Tyr Pro Gln Thr Thr Cys Ile Arg Lys Gly Trp Val Thr Gln Gln Leu
 65 70 75 80
 Ile Lys Cys Val Val Phe Thr Gly Leu Met Gly Phe Ile Ile Glu Gln
 85 90 95
 Tyr Ile Asn Pro Ile Val Lys Asn Ser Lys His Pro Leu Lys Gly Asn
 100 105 110
 Phe Leu Asn Ala Ile Glu Arg Val Leu Lys Leu Ser Val Pro Thr Leu
 115 120 125
 Tyr Val Trp Leu Cys Met Phe Tyr Cys Phe Phe His Leu Trp Leu Asn
 130 135 140
 Ile Val Ala Xaa Leu Leu Cys Phe Gly Asp Arg Glu Phe Tyr Lys Asp
 145 150 155 160
 Trp Trp Asn Xaa Lys Thr Val Glu Glu Tyr Trp Arg Met Trp Asn Met
 165 170 175
 Pro Val His Lys Trp Ile Ile Arg His Ile Tyr Phe Pro Cys Ile Arg
 180 185 190
 Xaa Gly Phe Ser Arg Gly Val Ala Ile Leu Ile Ser Phe Leu Val Ser
 195 200 205

Ala Val Phe His Glu Ile Cys Ile Ala Val Pro Cys His Ile Phe Lys
 210 215 220

Phe Trp Ala Phe Ser Gly Ile Met Phe Gln Ile Pro Leu Val Phe Leu
 225 230 235 240

Thr Arg Tyr Leu His Ala Thr Phe Lys His Val Met Val Gly Asn Met
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 tttcaacctt tgcattgttg ttctagtgtc agtgaacagc aggcttatta tcgagaactt 180
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<210> 12
 <211> 80
 <212> PRT
 <213> Oryza sativa

<400> 12
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 1 5 10 15

Pro Val His Arg Lys Ala Lys Glu Ser Pro Leu Ser Ser Asp Ala Ile
 20 25 30

Phe Lys Gln Ser His Ala Gly Leu Phe Asn Leu Cys Ile Val Val Leu
 35 40 45

Val Ala Val Asn Ser Arg Leu Ile Ile Glu Asn Leu Met Lys Tyr Gly
 50 55 60

Leu Leu Ile Arg Ala Gly Phe Trp Phe Asn Asp Lys Ser Leu Arg Asp
 65 70 75 80

<210> 13
 <211> 1587
 <212> DNA
 <213> Oryza sativa

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 ttgcagttga aaagttaggca tttaacaatg ttattactga tgctgttgct acctgcctcc 360

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atattcttctt ttcaacaacc gaaattgtat atccagtgt tgtgattctt aagtgtgatt 420
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tatcttttgc acatacaaac catgatataa ggcaactgac catgggcggc aagaagggtg 540
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tttccgaaaa aaaaaaaaaa aaaaaaa 1587

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<210> 14
 <211> 500
 <212> PRT
 <213> *Oryza sativa*

<400> 14
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 20 25 30
 Asp Glu Ala Ala Pro Gly Ser Pro Pro Arg Pro Arg Pro Arg Pro Arg
 35 40 45
 Pro Arg Gly Gly Asp Ser Asn Gly Arg Ser Val Leu Arg Pro Gly Gly
 50 55 60
 Gly Gly Gly Arg Gly Gly Gly Gly Asp Phe Ser Ala Phe Thr Phe Arg
 65 70 75 80
 Ala Ala Ala Pro Val His Arg Lys Ala Lys Glu Ser Pro Leu Ser Ser
 85 90 95
 Asp Ala Ile Phe Lys Gln Ser His Ala Gly Leu Phe Asn Leu Cys Ile
 100 105 110
 Val Val Leu Val Ala Val Asn Ser Arg Leu Ile Ile Glu Asn Leu Met
 115 120 125
 Lys Tyr Gly Leu Leu Ile Arg Ala Gly Phe Trp Phe Asn Asp Lys Ser
 130 135 140
 Leu Arg Asp Trp Pro Leu Leu Met Cys Cys Leu Ser Leu Pro Ala Phe
 145 150 155 160
 Pro Leu Gly Ala Phe Ala Val Glu Lys Leu Ala Phe Asn Asn Val Ile
 165 170 175

Thr Asp Ala Val Ala Thr Cys Leu His Ile Phe Leu Ser Thr Thr Glu
 180 185 190
 Ile Val Tyr Pro Val Leu Val Ile Leu Lys Cys Asp Ser Ala Val Leu
 195 200 205
 Ser Gly Phe Leu Leu Ile Phe Ile Ala Cys Ile Val Trp Leu Lys Leu
 210 215 220
 Val Ser Phe Ala His Thr Asn His Asp Ile Arg Gln Leu Thr Met Gly
 225 230 235 240
 Gly Lys Lys Val Asp Asn Glu Leu Ser Thr Val Asp Met Asp Asn Leu
 245 250 255
 Gln Pro Pro Thr Leu Gly Asn Leu Ile Tyr Phe Met Met Ala Pro Thr
 260 265 270
 Leu Cys Tyr Gln Pro Ser Tyr Pro Arg Thr Ser Cys Val Arg Lys Gly
 275 280 285
 Trp Leu Ile Arg Gln Ile Ile Leu Tyr Leu Ile Phe Thr Gly Leu Gln
 290 295 300
 Gly Phe Ile Ile Glu Gln Tyr Ile Asn Pro Ile Val Val Asn Ser Gln
 305 310 315 320
 His Pro Leu Lys Gly Gly Leu Leu Asn Ala Val Glu Thr Val Leu Lys
 325 330 335
 Leu Ser Leu Pro Asn Val Tyr Leu Trp Leu Cys Met Phe Tyr Ala Phe
 340 345 350
 Phe His Leu Trp Leu Ser Ile Leu Ala Glu Ile Leu Arg Phe Gly Asp
 355 360 365
 Arg Glu Phe Tyr Lys Asp Trp Trp Asn Ala Lys Thr Ile Asp Glu Tyr
 370 375 380
 Trp Arg Lys Trp Asn Met Pro Val His Lys Trp Val Val Arg His Ile
 385 390 395 400
 Tyr Phe Pro Cys Met Arg Asn Gly Ile Ser Lys Glu Val Ala Val Leu
 405 410 415
 Ile Ser Phe Leu Val Ser Ala Val Leu His Glu Ile Cys Val Ala Val
 420 425 430
 Pro Cys Arg Ile Leu Lys Phe Trp Ala Phe Leu Gly Ile Met Leu Gln
 435 440 445
 Ile Pro Leu Ile Val Leu Thr Ala Tyr Leu Lys Ser Lys Phe Arg Asp
 450 455 460
 Thr Met Val Gly Asn Met Ile Phe Trp Phe Phe Phe Cys Ile Tyr Gly
 465 470 475 480
 Gln Pro Met Cys Leu Leu Leu Tyr Tyr His Asp Val Met Asn Arg Ile
 485 490 495

Glu Lys Ala Arg
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<210> 15
<211> 1942
<212> DNA
<213> Glycine max

<400> 15
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cttcaattcg cctgagacaa ccaccgacag ttccgggtgat gacttggcca aggattctgg 180
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acaagacact gattttctccg tcctcaaatt cgcctaccgt ccttccgtcc ccgctcaccg 300
caaagtgaag gaaagtcgcg tcagctccga cactattttc cgtcagagtc acgcgggcct 360
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cattacctca acttcgcttt tctatccagt tttagttatt ctgaggtgtg atttgccttt 660
tgtatcaggt gtcacgttaa tgctgttttc ttgtgttgta tgggttaaaat tgggtgtctta 720
tgcacataca aactatgata tgagagcact taccaaatta gttgaaaagg gagaagcact 780
gctcgatact ctgaacatgg actatcctta caacgtaagc ttcaagagct tggcatattt 840
cctgggtgcc cctacattat gttaccagcc aagctatcct cgcacacctt atattcgaaa 900
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aatagaccaa tatattaatc ccatagtaca aaattcacag catcctctca agggaaacct 1020
tctttacgcc accgagagag ttctgaagct ttctgttcca aatttatatg tgtggctctg 1080
catgttctat tgctttttcc acctttgggt aaatatcctg gcagagcttc ttcgatttgg 1140
tgtcgtgaa ttctacaagg attgggtggaa tgccaaaact gtogaagatt attggaggat 1200
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tcaggttctt ttggtcttga tctaatta tctgcaaaat aaattcagaa actcaatggg 1440
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atactaccat gacttgatga ataggaaagg caaacttgac tgaagctacg gccattacat 1560
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ttggtcaata ttgtttttct acgaatgctt tcatctacca tggcattggc tgctctgaag 1680
gaattccacg ggatatgcca gttcacgagg ctaattcatt atcttgatct atgtacttac 1740
caactctcct ctggcaattg tatcaaaata tgcaattttg agagccatac actggcattg 1800
ataactgcca aggaacactc taactgtttt ctgttaactg ttaattagta gagggctaga 1860
tgtaaatggg ttatgctcaa tatatttatt tcctcctaaa aaaaaaaaaa aaaaaaaaaa 1920
aaaaaaaaaa aaaaaaaaaa aa 1942

<210> 16
<211> 504
<212> PRT
<213> Glycine max

<400> 16
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1 5 10 15
Ser Ser Leu Arg Arg Pro Ser Ala Thr Ser Thr Ala Gly Leu Phe
20 25 30
Asn Ser Pro Glu Thr Thr Thr Asp Ser Ser Gly Asp Asp Leu Ala Lys
35 40 45

Asp Ser Gly Ser Asp Asp Ser Ile Asn Ser Asp Asp Ala Ala Val Asn
 50 55 60
 Ser Gln Gln Gln Asn Glu Lys Gln Asp Thr Asp Phe Ser Val Leu Lys
 65 70 75 80
 Phe Ala Tyr Arg Pro Ser Val Pro Ala His Arg Lys Val Lys Glu Ser
 85 90 95
 Pro Leu Ser Ser Asp Thr Ile Phe Arg Gln Ser His Ala Gly Leu Phe
 100 105 110
 Asn Leu Cys Ile Val Val Leu Val Ala Val Asn Ser Arg Leu Ile Ile
 115 120 125
 Glu Asn Leu Met Lys Tyr Gly Trp Leu Ile Lys Ser Gly Phe Trp Phe
 130 135 140
 Ser Ser Lys Ser Leu Arg Asp Trp Pro Leu Phe Met Cys Cys Leu Ser
 145 150 155 160
 Leu Val Val Phe Pro Phe Ala Ala Phe Ile Val Glu Lys Leu Ala Gln
 165 170 175
 Arg Lys Cys Ile Pro Glu Pro Val Val Val Val Leu His Ile Ile Ile
 180 185 190
 Thr Ser Thr Ser Leu Phe Tyr Pro Val Leu Val Ile Leu Arg Cys Asp
 195 200 205
 Ser Ala Phe Val Ser Gly Val Thr Leu Met Leu Phe Ser Cys Val Val
 210 215 220
 Trp Leu Lys Leu Val Ser Tyr Ala His Thr Asn Tyr Asp Met Arg Ala
 225 230 235 240
 Leu Thr Lys Leu Val Glu Lys Gly Glu Ala Leu Leu Asp Thr Leu Asn
 245 250 255
 Met Asp Tyr Pro Tyr Asn Val Ser Phe Lys Ser Leu Ala Tyr Phe Leu
 260 265 270
 Val Ala Pro Thr Leu Cys Tyr Gln Pro Ser Tyr Pro Arg Thr Pro Tyr
 275 280 285
 Ile Arg Lys Gly Trp Leu Phe Arg Gln Leu Val Lys Leu Ile Ile Phe
 290 295 300
 Thr Gly Val Met Gly Phe Ile Ile Asp Gln Tyr Ile Asn Pro Ile Val
 305 310 315 320
 Gln Asn Ser Gln His Pro Leu Lys Gly Asn Leu Leu Tyr Ala Thr Glu
 325 330 335
 Arg Val Leu Lys Leu Ser Val Pro Asn Leu Tyr Val Trp Leu Cys Met
 340 345 350
 Phe Tyr Cys Phe Phe His Leu Trp Leu Asn Ile Leu Ala Glu Leu Leu
 355 360 365

Arg Phe Gly Asp Arg Glu Phe Tyr Lys Asp Trp Trp Asn Ala Lys Thr
 370 375 380
 Val Glu Asp Tyr Trp Arg Met Trp Asn Met Pro Val His Lys Trp Met
 385 390 395 400
 Ile Arg His Leu Tyr Phe Pro Cys Leu Arg His Gly Leu Pro Lys Ala
 405 410 415
 Ala Ala Leu Leu Ile Ala Phe Leu Val Ser Ala Leu Phe His Glu Leu
 420 425 430
 Cys Ile Ala Val Pro Cys His Ile Phe Lys Leu Trp Ala Phe Gly Gly
 435 440 445
 Ile Met Phe Gln Val Pro Leu Val Leu Ile Thr Asn Tyr Leu Gln Asn
 450 455 460
 Lys Phe Arg Asn Ser Met Val Gly Asn Met Ile Phe Trp Phe Ile Phe
 465 470 475 480
 Ser Ile Leu Gly Gln Pro Met Cys Val Leu Leu Tyr Tyr His Asp Leu
 485 490 495
 Met Asn Arg Lys Gly Lys Leu Asp
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<210> 17
 <211> 470
 <212> DNA
 <213> Glycine max

<220>
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 <222> (372)

<220>
 <221> unsure
 <222> (424)

<220>
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<220>
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<220>
 <221> unsure
 <222> (469)

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 cgcccagagac gaccaccgac agttccgggtg atgacttggc caaggattcc ggttcgacg 180
 actccatcag cagcgacgcc gccaatcgc aaccgcaaca aaaacaagac actgatttct 240
 ccgtcctcaa attcgcttac cgtccttcgc tcccgcgtca tcgcaaagtg aaggaaaagtc 300
 cgctcagctc ccgacaccat tttccgtcag aagtcacgcg gggcctcttc aacctcctgt 360

atagtaagtc cntgttgctg tgaataagcc gactcatcat tgagaatttt aaatgaaata 420
 tggnttgggt tgatcaaadc cnggcntttt gggttaagct caaagtcant 470

<210> 18
 <211> 38
 <212> PRT
 <213> Glycine max

<400> 18
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 1 5 10 15

Arg Lys Val Lys Glu Ser Pro Leu Ser Ser Asp Thr Ile Phe Val Arg
 20 25 30

Ser His Ala Gly Pro Leu
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<210> 19
 <211> 646
 <212> DNA
 <213> Triticum aestivum

<220>
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<220>
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 agctgggttt tggtttaagt gcaagatcgc tgggagattg gccacttctg atgtgctgcc 180
 tcaactttacc cattttccca cttgctgctc tcatgaccgg agaattgggt caaaagaaan 240
 tcatccgtgg atcatgtgtc tatcctcccc catataatta ttacaaccac tgccttatac 300
 ctatccggtg ntgtgatcct taaagtgtga accacantat atcctgggtt gtgnttatgt 360
 ccattgcaan atacttgggt gancttgnc cttttgctcc atacaattag atataagtat 420
 tgncccaaaa ntatngaaag ggtgctacac agggattcta ccnagaagaa aattaaagcc 480
 caactncaac aagtgtgtat cangttggcc caacactggt acaaccaatt taccggcan 540
 attatanaaa ggtgggtcacc ggaactataa agtgtatttt aagcttatgg ctcaaattggc 600
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<210> 20
 <211> 39
 <212> PRT
 <213> Triticum aestivum

<400> 20
 Ser Asp Ala Ile Phe Arg Gln Ser His Ala Gly Leu Leu Asn Leu Cys
 1 5 10 15
 Ile Val Val Leu Ile Ala Val Asn Ser Arg Leu Ile Ile Glu Asn Leu
 20 25 30

Met Lys Tyr Gly Leu Leu Ile
35

<210> 21
<211> 1975
<212> DNA
<213> Triticum aestivum

<220>
<221> unsure
<222> (93)

<400> 21
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cgaagataac acgacctgcc acatgtgttt tgtgtatacg tttcggttca tgtgccagca 1920
gagttacgta cgtgatgccc tgttgatat aaagtgtacg tgccgtatga aaaaa 1975

<210> 22
<211> 508
<212> PRT
<213> Triticum aestivum

<400> 22
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1 5 10 15
Ser His Gly Gly Pro Pro Pro Lys Pro Lys Thr Pro Pro Arg Thr Phe
20 25 30

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Arg | Asn | Leu | Pro | Ser | Ser | Ser | Thr | His | Gly | Pro | Ala | Pro | Ser | Val | Ala | |
| | | 35 | | | | | 40 | | | | | 45 | | | | |
| Ala | Ala | Thr | Ile | Ala | Thr | Thr | Pro | Pro | Ser | Ala | Ser | Ala | Ala | Pro | Leu | |
| | | 50 | | | | 55 | | | | | 60 | | | | | |
| Pro | Pro | Thr | Val | His | Gly | Glu | Ala | Ala | His | Gly | Ala | Ala | Ala | Ala | Ala | |
| | 65 | | | | 70 | | | | | 75 | | | | | 80 | |
| Arg | Arg | Asp | Ala | Leu | Leu | Pro | Gly | Val | Gly | Ala | Ala | His | Arg | Arg | Val | |
| | | | | 85 | | | | | 90 | | | | | 95 | | |
| Lys | Glu | Ser | Pro | Leu | Ser | Ser | Asp | Ala | Ile | Phe | Arg | Gln | Ser | His | Ala | |
| | | | 100 | | | | | 105 | | | | | 110 | | | |
| Gly | Leu | Leu | Asn | Leu | Cys | Ile | Val | Val | Leu | Ile | Ala | Val | Asn | Ser | Arg | |
| | | 115 | | | | | 120 | | | | | 125 | | | | |
| Leu | Ile | Ile | Glu | Asn | Leu | Met | Lys | Tyr | Gly | Leu | Leu | Ile | Arg | Ala | Gly | |
| | 130 | | | | | 135 | | | | | 140 | | | | | |
| Phe | Trp | Phe | Ser | Ala | Arg | Ser | Leu | Gly | Asp | Trp | Pro | Leu | Leu | Met | Cys | |
| | 145 | | | | 150 | | | | | 155 | | | | | 160 | |
| Cys | Leu | Thr | Leu | Pro | Ile | Phe | Pro | Leu | Ala | Ala | Leu | Met | Thr | Glu | Lys | |
| | | | | 165 | | | | | 170 | | | | | 175 | | |
| Trp | Ala | Gln | Arg | Lys | Leu | Ile | Arg | Asp | His | Val | Ser | Ile | Leu | Leu | His | |
| | | | 180 | | | | | 185 | | | | | 190 | | | |
| Ile | Ile | Ile | Thr | Thr | Thr | Val | Leu | Ile | Tyr | Pro | Val | Val | Val | Ile | Leu | |
| | | 195 | | | | | 200 | | | | | 205 | | | | |
| Lys | Cys | Glu | Ser | Ala | Val | Leu | Ser | Gly | Phe | Val | Leu | Met | Phe | Ile | Ala | |
| | 210 | | | | | 215 | | | | | 220 | | | | | |
| Ser | Ile | Thr | Trp | Leu | Lys | Leu | Val | Ser | Phe | Ala | His | Thr | Asn | Tyr | Asp | |
| | 225 | | | | 230 | | | | | 235 | | | | | 240 | |
| Ile | Arg | Ile | Leu | Ser | Gln | Ser | Ile | Glu | Lys | Gly | Ala | Thr | His | Gly | Ser | |
| | | | | 245 | | | | | 250 | | | | | 255 | | |
| Ser | Ile | Asp | Glu | Glu | Asn | Ile | Lys | Gly | Pro | Thr | Ile | Asn | Ser | Val | Val | |
| | | | 260 | | | | | 265 | | | | | 270 | | | |
| Tyr | Phe | Met | Leu | Ala | Pro | Thr | Leu | Cys | Tyr | Gln | Pro | Ser | Tyr | Pro | Arg | |
| | | 275 | | | | | 280 | | | | | 285 | | | | |
| Thr | Ala | Phe | Ile | Arg | Lys | Gly | Trp | Val | Thr | Arg | Gln | Leu | Ile | Lys | Cys | |
| | 290 | | | | | 295 | | | | | 300 | | | | | |
| Val | Val | Phe | Thr | Gly | Leu | Met | Gly | Phe | Ile | Ile | Glu | Gln | Tyr | Ile | Asn | |
| | 305 | | | | 310 | | | | | 315 | | | | | 320 | |
| Pro | Ile | Val | Gln | Asn | Ser | Lys | His | Pro | Leu | Asn | Gly | Asn | Phe | Leu | Asp | |
| | | | | 325 | | | | | 330 | | | | | 335 | | |
| Ala | Ile | Glu | Arg | Val | Leu | Lys | Leu | Ser | Val | Pro | Thr | Leu | Tyr | Val | Trp | |
| | | | 340 | | | | | 345 | | | | | 350 | | | |

Leu Cys Met Phe Tyr Ser Phe Phe His Leu Trp Leu Asn Ile Leu Ala
 355 360 365
 Glu Leu Leu Arg Phe Gly Asp Arg Glu Phe Tyr Lys Asp Trp Trp Asn
 370 375 380
 Ala Lys Thr Val Glu Glu Tyr Trp Arg Met Trp Asn Met Pro Val His
 385 390 395 400
 Lys Trp Ile Val Arg His Ile Tyr Phe Pro Cys Ile Arg Asn Gly Leu
 405 410 415
 Ser Lys Gly Cys Ala Ile Leu Ile Ala Phe Leu Val Ser Ala Val Phe
 420 425 430
 His Glu Leu Cys Ile Ala Val Pro Cys His Ile Phe Lys Leu Trp Ala
 435 440 445
 Phe Ser Gly Ile Met Phe Gln Ile Pro Leu Leu Phe Leu Thr Lys Tyr
 450 455 460
 Leu Gln Asp Lys Phe Lys Asn Thr Met Val Gly Asn Met Ile Phe Trp
 465 470 475 480
 Phe Phe Phe Ser Ile Val Gly Gln Pro Met Cys Val Leu Leu Tyr Tyr
 485 490 495
 His Asp Val Met Asn Arg Gln Ala Gln Thr Asn Gly
 500 505

<210> 23
 <211> 20
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:PCR primer

<400> 23
 cttagcttct tccttcaatc 20

<210> 24
 <211> 33
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence:PCR primer

<400> 24
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<210> 25
 <211> 497
 <212> PRT
 <213> Mus musculus

<400> 25
 Met Gly Asp Arg Gly Gly Ala Gly Ser Ser Arg Arg Arg Thr Gly Ser
 1 5 10 15

Arg Val Ser Val Gln Gly Gly Ser Gly Pro Lys Val Glu Glu Asp Glu
 20 25 30
 Val Arg Asp Ala Ala Val Ser Pro Asp Leu Gly Ala Gly Gly Asp Ala
 35 40 45
 Pro Ala Pro Ala Pro Ala Pro Ala His Thr Arg Asp Lys Asp Gly Arg
 50 55 60
 Thr Ser Val Gly Asp Gly Tyr Trp Asp Leu Arg Cys His Arg Leu Gln
 65 70 75 80
 Asp Ser Leu Phe Ser Ser Asp Ser Gly Phe Ser Asn Tyr Arg Gly Ile
 85 90 95
 Leu Asn Trp Cys Val Val Met Leu Ile Leu Ser Asn Ala Arg Leu Phe
 100 105 110
 Leu Glu Asn Leu Ile Lys Tyr Gly Ile Leu Val Asp Pro Ile Gln Val
 115 120 125
 Val Ser Leu Phe Leu Lys Asp Pro Tyr Ser Trp Pro Ala Pro Cys Val
 130 135 140
 Ile Ile Ala Ser Asn Ile Phe Val Val Ala Ala Phe Gln Ile Glu Lys
 145 150 155 160
 Arg Leu Ala Val Gly Ala Leu Thr Glu Gln Met Gly Leu Leu Leu His
 165 170 175
 Val Val Asn Leu Ala Thr Ile Ile Cys Phe Pro Ala Ala Val Ala Leu
 180 185 190
 Leu Val Glu Ser Ile Thr Pro Val Gly Ser Val Phe Ala Leu Ala Ser
 195 200 205
 Tyr Ser Ile Met Phe Leu Lys Leu Tyr Ser Tyr Arg Asp Val Asn Leu
 210 215 220
 Trp Cys Arg Gln Arg Arg Val Lys Ala Lys Ala Val Ser Thr Gly Lys
 225 230 235 240
 Lys Val Ser Gly Ala Ala Ala Gln Gln Ala Val Ser Tyr Pro Asp Asn
 245 250 255
 Leu Thr Tyr Arg Asp Leu Tyr Tyr Phe Ile Phe Ala Pro Thr Leu Cys
 260 265 270
 Tyr Glu Leu Asn Phe Pro Arg Ser Pro Arg Ile Arg Lys Arg Phe Leu
 275 280 285
 Leu Arg Arg Val Leu Glu Met Leu Phe Phe Thr Gln Leu Gln Val Gly
 290 295 300
 Leu Ile Gln Gln Trp Met Val Pro Thr Ile His Asn Ser Met Lys Pro
 305 310 315 320
 Phe Lys Asp Met Asp Tyr Ser Arg Ile Ile Glu Arg Leu Leu Lys Leu
 325 330 335

Ala Val Pro Asn His Leu Ile Trp Leu Ile Phe Phe Tyr Trp Phe Phe
340 345 350

His Ser Cys Leu Asn Ala Val Ala Glu Leu Leu Gln Phe Gly Asp Arg
355 360 365

Glu Phe Tyr Arg Asp Trp Trp Asn Ala Glu Ser Val Thr Tyr Phe Trp
370 375 380

Gln Asn Trp Asn Ile Pro Val His Lys Trp Cys Ile Arg His Phe Tyr
385 390 395 400

Lys Pro Met Leu Arg His Gly Ser Ser Lys Trp Val Ala Arg Thr Gly
405 410 415

Val Phe Leu Thr Ser Ala Phe Phe His Glu Tyr Leu Val Ser Val Pro
420 425 430

Leu Arg Met Phe Arg Leu Trp Ala Phe Thr Ala Met Met Ala Gln Val
435 440 445

Pro Leu Ala Trp Ile Val Gly Arg Phe Phe Gln Gly Asn Tyr Gly Asn
450 455 460

Ala Ala Val Trp Val Thr Leu Ile Ile Gly Gln Pro Val Ala Val Leu
465 470 475 480

Met Tyr Val His Asp Tyr Tyr Val Leu Asn Tyr Asp Ala Pro Val Gly
485 490 495

Val

<210> 26
<211> 520
<212> PRT
<213> Arabidopsis thaliana

<400> 26
Met Ala Ile Leu Asp Ser Ala Gly Val Thr Thr Val Thr Glu Asn Gly
1 5 10 15

Gly Gly Glu Phe Val Asp Leu Asp Arg Leu Arg Arg Arg Lys Ser Arg
20 25 30

Ser Asp Ser Ser Asn Gly Leu Leu Leu Ser Gly Ser Asp Asn Asn Ser
35 40 45

Pro Ser Asp Asp Val Gly Ala Pro Ala Asp Val Arg Asp Arg Ile Asp
50 55 60

Ser Val Val Asn Asp Asp Ala Gln Gly Thr Ala Asn Leu Ala Gly Asp
65 70 75 80

Asn Asn Gly Gly Gly Asp Asn Asn Gly Gly Gly Arg Gly Gly Gly Glu
85 90 95

Gly Arg Gly Asn Ala Asp Ala Thr Phe Thr Tyr Arg Pro Ser Val Pro
100 105 110

| | | | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ala | His | Arg | Arg | Ala | Arg | Glu | Ser | Pro | Leu | Ser | Ser | Asp | Ala | Ile | Phe | 115 | 120 | 125 |
| Lys | Gln | Ser | His | Ala | Gly | Leu | Phe | Asn | Leu | Cys | Val | Val | Val | Leu | Ile | 130 | 135 | 140 |
| Ala | Val | Asn | Ser | Arg | Leu | Ile | Ile | Glu | Asn | Leu | Met | Lys | Tyr | Gly | Trp | 145 | 150 | 155 |
| Leu | Ile | Arg | Thr | Asp | Phe | Trp | Phe | Ser | Ser | Arg | Ser | Leu | Arg | Asp | Trp | 165 | 170 | 175 |
| Pro | Leu | Phe | Met | Cys | Cys | Ile | Ser | Leu | Ser | Ile | Phe | Pro | Leu | Ala | Ala | 180 | 185 | 190 |
| Phe | Thr | Val | Glu | Lys | Leu | Val | Leu | Gln | Lys | Tyr | Ile | Ser | Glu | Pro | Val | 195 | 200 | 205 |
| Val | Ile | Phe | Leu | His | Ile | Ile | Ile | Thr | Met | Thr | Glu | Val | Leu | Tyr | Pro | 210 | 215 | 220 |
| Val | Tyr | Val | Thr | Leu | Arg | Cys | Asp | Ser | Ala | Phe | Leu | Ser | Gly | Val | Thr | 225 | 230 | 235 |
| Leu | Met | Leu | Leu | Thr | Cys | Ile | Val | Trp | Leu | Lys | Leu | Val | Ser | Tyr | Ala | 245 | 250 | 255 |
| His | Thr | Ser | Tyr | Asp | Ile | Arg | Ser | Leu | Ala | Asn | Ala | Ala | Asp | Lys | Ala | 260 | 265 | 270 |
| Asn | Pro | Glu | Val | Ser | Tyr | Tyr | Val | Ser | Leu | Lys | Ser | Leu | Ala | Tyr | Phe | 275 | 280 | 285 |
| Met | Val | Ala | Pro | Thr | Leu | Cys | Tyr | Gln | Pro | Ser | Tyr | Pro | Arg | Ser | Ala | 290 | 295 | 300 |
| Cys | Ile | Arg | Lys | Gly | Trp | Val | Ala | Arg | Gln | Phe | Ala | Lys | Leu | Val | Ile | 305 | 310 | 315 |
| Phe | Thr | Gly | Phe | Met | Gly | Phe | Ile | Ile | Glu | Gln | Tyr | Ile | Asn | Pro | Ile | 325 | 330 | 335 |
| Val | Arg | Asn | Ser | Lys | His | Pro | Leu | Lys | Gly | Asp | Leu | Leu | Tyr | Ala | Ile | 340 | 345 | 350 |
| Glu | Arg | Val | Leu | Lys | Leu | Ser | Val | Pro | Asn | Leu | Tyr | Val | Trp | Leu | Cys | 355 | 360 | 365 |
| Met | Phe | Tyr | Cys | Phe | Phe | His | Leu | Trp | Leu | Asn | Ile | Leu | Ala | Glu | Leu | 370 | 375 | 380 |
| Leu | Cys | Phe | Gly | Asp | Arg | Glu | Phe | Tyr | Lys | Asp | Trp | Trp | Asn | Ala | Lys | 385 | 390 | 395 |
| Ser | Val | Gly | Asp | Tyr | Trp | Arg | Met | Trp | Asn | Met | Pro | Val | His | Lys | Trp | 405 | 410 | 415 |
| Met | Val | Arg | His | Ile | Tyr | Phe | Pro | Cys | Leu | Arg | Ser | Lys | Ile | Pro | Lys | 420 | 425 | 430 |

Thr Leu Ala Ile Ile Ile Ala Phe Leu Val Ser Ala Val Phe His Glu
 435 440 445
 Leu Cys Ile Ala Val Pro Cys Arg Leu Phe Lys Leu Trp Ala Phe Leu
 450 455 460
 Gly Ile Met Phe Gln Val Pro Leu Val Phe Ile Thr Asn Tyr Leu Gln
 465 470 475 480
 Glu Arg Phe Gly Ser Thr Val Gly Asn Met Ile Phe Trp Phe Ile Phe
 485 490 495
 Cys Ile Phe Gly Gln Pro Met Cys Val Leu Leu Tyr Tyr His Asp Leu
 500 505 510
 Met Asn Arg Lys Gly Ser Met Ser
 515 520